(3) A number of secondary actinometric stations should be established in each country. These stations may be equipped with secondary instruments for relative measurements, standardized through comparison at the central station of the country.

(4) The commission discussed the proposition of Doctor Ångström relative to "The possibility of obtaining economic support for an effective international cooperation in meteorological radiation researches." A subcommission consisting of Messrs. Maurer, Ångström, Chistoni, Dines, Gorczyński, and Stenz was appointed to investigate the necessary expenses of maintaining a central institute charged with the comparison and control of instruments.

(5) The discussion of the proposition of Professor Chistoni regarding a new terminology in regard to certain instruments and branches of radiation research, was postponed to a later meeting.

(6) In regard to the proposal of Professor Chistoni that the central institute be located at Potenza, Italy, the commission may refer to the discussion presented by Messrs. Ångström and Lindholm (Appendix I). Further discussions were postponed to the next meeting.

(7) According to a proposition by Doctor Kimball (United States), the commission decided to emphasize the desirability of further investigations regarding the possible existence of an influence of cosmical dust upon the variations of solar radiation.

B. Questions regarding instruments.—(1) The commission decided to indorse the opinions expressed by Messrs. Ångström and Lindholm in a report read before the commission "Regarding a central actinometric station and the pyrheliometric scale", and decided that this report should be added to the protocol as an appendix. (See Appendix I.)

(2) The commission decided to adopt the opinions expressed in a report of Doctor Ångström "On actinometric investigations of solar and atmospheric radiation," read at the meeting, and decided that this report should be added as an appendix to the protocol.[3]

(3) A paper by Doctor Lindholm "Sur la variation de la constants solaire d'après les mesures spectrobolométriques de M. Abbot et d'après les mesures pyrhéliométriques dans des parties limitées du spectre" was presented at the meeting by Doctor Ångström and the commission decided to include it in their transactions.

(4) In regard to sunshine recording instruments, the commission decided to postpone any definite proposition until the investigation of Doctor Simpson on the same subject is published.

The commission expressed its perfect agreement with the opinion of Doctor Gorczyński that the organization of continuous actinometric measurements in the south of France and of temporary actinometric expeditions to desert regions, equatorial mountains, and to some isolated islands in the central part of the Pacific Ocean would be of great utility for the development of solar researches and a very important step for the realization of an international network of actinometric stations. The commission decided to include the report of Doctor Gorczyński as Appendix III to the protocol.

As new members of the commission were proposed and elected: Boutaric, Dongier, Maurain, Rey (France), Hergesell, Süring (Germany), Kalitin (Russia), Exner, Schmidt (Austria), Schoute, Boerema (Holland), and Dorno, Davos (Switzerland).

[3] Appendix II. An abstract is promised at a later date.—H. H. K.

APPENDIX I.

REMARKS REGARDING A CENTRAL ACTINOMETRIC STATION AND REGARDING THE PYRHELIOMETRIC STANDARD SCALE.

By F. LINDHOLM and A. ÅNGSTRÖM.

At the meeting of the International Union for Cooperation in Solar Research at Mendon in 1907 it was decided that the central actinometric station should be located at Upsala.

According to a former decision at the Oxford meeting of the same union, the compensation pyrheliometer of K. Ångström was accepted as a standard instrument for measuring solar radiation. The "normal" of this instrument was to be kept at the central station for comparison with instruments furnished to various observers. The comparison was made by Ångström in a twofold way. For every instrument the heat produced through the compensation current was computed from a determination of the dimensions of the strip. Thus a computed constant of the instrument was obtained. An empirical value of the same constant was obtained through comparison with the normal. In order that the instrument should be approved, the two constants thus determined must agree within 1 per cent.

In a report to the meeting of the Meteorological Commission for the Study of Solar Radiation, at Rapperswil in 1912, Ångström's successor, Prof. G. Granqvist, showed that the standard instrument had remained unaltered during the time 1905–1912. In a paper on "Comparisons between pyrheliometers and the difference between the Ångström standard and the Smithsonian standard"[4] one of us later showed that the Upsala standard must have remained unchanged also during the time 1912–1918.

Investigations by Marten, Abbot, A. Ångström and others have shown that at present there exists a difference between the Ångström standard and the Smithsonian standard of about 3.5 per cent. For all instruments which are in an uninjured condition, this difference seems however only to vary within less than about 1 per cent. It is probably chiefly due to a small source of error, which was pointed out by one of us in 1913, and afterwards has been more closely investigated by Marten. The error is introduced through a border effect at the strips, which arises from the fact that the strip exposed to the radiation is not illuminated to its whole length.

This source of error is easily eliminated, through adding a certain constant correction to the computed constant.

The compensation pyrheliometers have the following important advantages:

(1) The standard as well as the secondaries are absolute instruments, of which the constants can be easily determined through measuring the width and resistance of the strips.

(2) The readings give momentary values of the radiation.

(3) The constant of the instrument is in high degree independent of climatic variables like temperature, convection and altitude.

The importance of a control of the auxiliary instrument, the milliammeter, must be emphasized.

The following proposals seem therefore justified by the previous discussions:

(1) That the Ångström standard pyrheliometer as well as the Smithsonian, constructed by Abbot, may be used as international standards.

[4] Mo. WEATHER REV., November, 1919.

(2) That a preliminary correction of +3.5 per cent may be applied to the readings of the Ångström pyrheliometers.

(3) That the central station will be charged with (1) the construction of a standard water flow pyrheliometer and (2) a comparison between the water flow and the Ångström compensation instrument.

[This proposal that the Central European station construct a standard water-flow pyrheliometer for the purpose of obtaining comparisons with the Ångström compensation pyrheliometer will be well received by American meteorologists. It is only necessary to call attention to a paper entitled "Some characteristics of the Marvin pyrheliometer" by Paul D. Foote, Scientific Papers of the Bureau of Standards No. 323, and to an abstract by the undersigned in the REVIEW for November, 1918, 46:499, to show that European investigators of solar radiation are now falling into line with their American colleagues.

It is interesting to note that the Marvin pyrheliometer when independently standardized gives radiation measurements 2 per cent lower than the Standard water-flow pyrheliometer constructed by Abbot. This is quite comparable with the difference between the Ångström and the standard water-flow pyrheliometers as given above. As indicated by both Ångström and Foote, this difference is within the probable error of calibration of the Ångström and Marvin instruments. However, the construction of a standard water-flow pyrheliometer by the central actinometric station for Europe may be expected to yield valuable results.—*H. H. K.*]

Regarding the central station it is important that it be closely connected with the construction and furnishing of the pyrheliometers. At present (since the failure of the Rose Company at Upsala) there seems to be a possibility of constructing and furnishing compensation pyrheliometers at Stockholm under scientific control. The chief of the physical institute at Upsala is willing to exert control over the pyrheliometers, and a special assistant is engaged to make the comparisons. We therefore propose that no alteration be made at present in the decision at the meeting at Mendon, according to which Upsala was selected as central station.

It seems, however, desirable that a second central station be selected for southern Europe, under the condition that a close collaboration between the stations can be relied upon. Especially a regular comparison of their standards seems necessary.

APPENDIX III.

PRELIMINARY REPORT OF DOCTOR GORCZYŃSKI ON THE RESULTS OBTAINED DURING HIS VOYAGE IN THE EQUATORIAL REGIONS, MARCH TO AUGUST, 1923.

Doctor Gorczyński, who had just returned from a voyage to the Far East, undertaken especially for actinometric studies, reported briefly on the work accomplished during his six months' sojourn aboard ship and in equatorial countries. Measurements of the intensity of solar radiation, not only total but partial (by means of colored glass), were made from March to August, 1923, by means of two bimetallic actinometers (Michelson type) compared before and after the journey, and also during the month of June, 1923, at the Observatory of Batavia (with an Abbot instrument). During the six months, he made a large number (about 50,000) of measurements from sunrise to sunset aboard the Danish motor ships *Jutlandia* and *Falstria*, and also in Siam and at Batavia and Pangerango (Java), the last named at an altitude of more than 3 kilometers.

While Doctor Gorczyński has not had an opportunity up to this time to reduce these measurements, he mentions the most interesting results obtained during the voyage:

(1) The measurements of partial intensity, made with colored glass, and especially with the highly monochromatic red Jena glass, show that the percentage of red radiation is less in the equatorial zone than in Europe: and, consequently, conditions are inverse in other parts of the spectrum. For example, in Siam and the Indian Ocean, one frequently finds that the red radiation comprises about 43 per cent, while in Europe it is generally about 50 per cent. This large difference depends only slightly on the solar altitude, which is generally less at noon in the temperate zone than in the Tropics.

(2) There was determined by continuous measurements between sunrise and sunset the diurnal variation of the total and partial intensity in the different geographic latitudes from 50° N. to 6° S. It was especially interesting to follow the diurnal variation of the percentage of red radiation which increases systematically, and considerably, with the decrease of solar altitude.

(3) The character of monthly variations of the intensity of solar radiation in the equatorial countries seems to be quite different from that which one observes in Europe. While in Europe it is especially the water vapor that influences the monthly variations, in the warm countries these variations depend principally on atmospheric opacity, which is quite different during the dry and wet seasons.

In spite of these results, Doctor Gorczyński considers that this voyage of study ought to be followed by others in different parts of the world, and especially in the desert countries (mountainous parts of the Sahara), and also by a prolonged sojourn on an island in the middle of the ocean (Tahiti for example). Similarly, it is necessary to establish for comparison a continuous series in Europe, and especially in the South of France, where atmospheric conditions are particularly favorable.

TABLE 1.—*Progressive diminution of the partial intensity in the "red part" of the solar spectrum in relation to the total intensity as determined by actinometric measurements made during the Polish expedition to Siam in 1923.*

(A) ACTINOMETRIC MEASUREMENTS ON BOARD THE MOTOR SHIP "JUTLANDIA" OF THE DANISH EAST-ASIATIC CO.

1923	At noon.			11-13 hours.			Remarks. Ship's position.
	Zenith distance.	Air mass.	Air temperature, C.	Max Q (gr. cal., cm², min.).	Per cent of the intensity in the "red part." Observ.	Reduced.	
Mar. 8...	43	1.38	16	1.39	50	64	Atlantic Ocean, 38° N., 10° W.
Mar. 13..	39	1.28	15	1.39	50	64	Mediterranean Sea, 36° N., 5° E.
Mar. 18..	30	1.15	21	1.22	48	61	Suez Canal, 29° N., 33° E.
Mar. 20..	22	1.09	28	1.24	47	60	Red Sea, 22° N., 38° E.
Mar. 23..	12	1.03	27	1.36	45	58	Gulf of Aden, 12° N., 44° E.
Mar. 28..	6	1.01	31	1.36	45	58	Indian Ocean, 10° N., 65° E.
Apr. 10..	5	1.01	29	1.28	45	58	Gulf of Siam, Pacific, 3° N., 101° E.

(B) ACTINOMETRIC MEASUREMENTS IN SIAM.

May 5...	2	1.00	32	1.15	45	58	City of Bangkok.
May 10..	4	1.01	32	1.11	45	58	Latitude, 13° 44′ N.
May 15..	5	1.01	33	1.25	45	58	Longitude, 100° 30′ E.
May 21..	6	1.01	33	1.22	44	56	Height, 10 m.